Date: Wednesday, 28/01/2009 8:16:58 AM
User: Jean-Luc Menard

# Process Sheet

| | | | |
|---|---|---|---|
| **Customer** | : CU-DAR001 Dart Helicopters Services | **Drawing Name** | : FLOAT WEB |
| **Job Number** | : 45304 | | |
| **Estimate Number** | : 10791 | | |
| **P.O. Number** | : | **Part Number** | : D3282041 |
| **This Issue** | : 28/01/2009 **S.O. No.** : | **Drawing Number** | : D3282 REV C |
| **Prsht Rev.** | : NC | **Project Number** | : N/A |
| **First Issue** | : / / **Type** : SKIDTUBES | **Drawing Revision** | : C |
| **Previous Run** | : 42319 | **Material** | : |
| **Written By** | : 09.01.28 | **Due Date** | : 04/02/2009 **Qty:** 12 **Um:** Each |
| **Checked & Approved By** | : | | |
| **Comment** | : Est Rev:B 05.09.23 Procedure change KJ/JLM | | |

**Additional Product**

Job Number:

| Seq. #: | Machine Or Operation: | Description : |
|---|---|---|
| 1.0 | D2792130 | EXTRUSION |

**Comment:** Qty.: 1.0000 Each(s)/Unit Total : 12.0000 Each(s)
Pick:

| Qty | Part Number | Description | Batch |
|---|---|---|---|
| 1 | D2792-130 | Extrusion | B423666 |

Identify as D3282-1 MB 09-01-28

| | | |
|---|---|---|
| 2.0 | SKIDTUBES 1 | SKIDTUBESS RESOURCE 1 |

**Comment:** LANDING GEAR RESOURCE 1

1-Cut to length as per Dwg D3282. MB 09-01-28

2- inspect for surface damage as per QSI0018

| | | |
|---|---|---|
| 3.0 | HAAS1 | HAAS CNC VERTICAL MACHINING #1 |

**Comment:** HAAS CNC VERTICAL MACHINING #1

1-Machine as per Folio FA579 & Dwg D3282

2-Deburr JL / M.A 09/02/31

| | | |
|---|---|---|
| 4.0 | QC2 | INSPECT PARTS AS THEY COME OFF MACHINE |

**Comment:** INSPECT PARTS AS THEY COME OFF MACHINE JL / M.A 09/02/31



Form: rprocess

**Dart Aerospace Ltd**

| W/O: | | WORK ORDER CHANGES | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | STEP | PROCEDURE CHANGE | By | Date | Qty | Approval Chief Eng / Prod Mgr | Approval QC Inspector |
| | | | | | | | |
| | | | | | | | |

Part No: D3282-041 PAR #: _____ Fault Category: _____ NCR: Yes (No) DQA: [signature] Date: 09/02/11

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

| NCR: 45304 | | WORK ORDER NON-CONFORMANCE (NCR) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DATE | STEP | Description of NC Section A | Corrective Action Section B | | | Verification Section C | Approval Chief Eng | Approval QC Inspector |
| | | | Initial Chief Eng | Action Description Chief Eng | Sign & Date | | | |
| 09.02.01 | 3 | THE 0.050 RIDGE WAS REMOVED ON ONE SIDE OF THE CENTRAL WEB ON SECTION A-A. REF ATTACHED DWG. | [signature] 09.02.03 pcr QS/C42 | I = 1.32 in⁴. FOR AFFECTED SECTION. MARGINS OF SAFETY STILL POSITIVE IN SR-D206-642-1. SEE ATTACHED. BLOCK MOVED DURING MACHINING. PROBLEM CORRECTED. | Julien Larocque [signature] 09/02/03 | [signature] 09/02/03 | [signature] 09.02.03 pcr QS/C42 | [signature] 09/02/03 |
| | | | | | | | | |
| | | | | | | | | |

**NOTE:** Date & initial all entries

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User: Jean-Luc Menard

# Process Sheet

**Customer:** CU-DAR001 Dart Helicopters Services **Drawing Name:** FLOAT WEB

**Job Number:** 45304 **Part Number:** D3282041

Job Number:

| Seq. #: | Machine Or Operation: | Description : |
|---|---|---|
| 5.0 | QC8 | SECOND CHECK |
| | **Comment:** SECOND CHECK | SE 09/02/09 |
| 6.0 | HAND FINISHING1 | HAND FINISHING RESOURCE #1 |
| | **Comment:** HAND FINISHING RESOURCE #1<br>Chemical Conversion Coat as per QSI 005 4.1 | FL/H 09/02/09 (1) |
| 7.0 | QC3 | INSPECT POWDER COAT/CHEMICAL CONVERSION |
| | **Comment:** INSPECT POWDER COAT/CHEMICAL CONVERSION | SE 09/02/09 (1&2) |
| 8.0 | D32831 | Doubler |
| | **Comment:** Qty.: 2.0000 Each(s)/Unit Total : 24.0000 Each(s)<br>Pick:<br>Qty Part Number Description Batch<br>2 D3283-1 Doubler B 42347 | 24 H 9-2-9 |
| 9.0 | MS20470AD47 | Rivet, Universal Head |
| | **Comment:** Qty.: 57.0000 Each(s)/Unit Total : 684.0000 Each(s)<br>Pick:<br>Qty Part Number Description Batch<br>57 MS20470AD4-7 Rivet M110002 | 635 H 9-2-9 |
| 10.0 | SKIDTUBES 1 | SKIDTUBESS RESOURCE 1 |
| | **Comment:** LANDING GEAR RESOURCE 1<br>1-Install doublers as per Dwg D3282. Apply LPS-3 between doublers and web<br>A/RN/ALPS-3 M 1735 | H 9-2-9 |
| 11.0 | QC5 | INSPECT WORK TO CURRENT STEP |
| | **Comment:** INSPECT WORK TO CURRENT STEP | SE 09/02/09 (1&2) |



Form: rprocess

Date: Wednesday, 28/01/2009 8:16:58 AM
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# Process Sheet

**Customer:** CU-DAR001 Dart Helicopters Services **Drawing Name:** FLOAT WEB

**Job Number:** 45304 **Part Number:** D3282041

Job Number:

| Seq. #: | Machine Or Operation: | Description : |
|---|---|---|
| 12.0 | PACKAGING 1 | PACKAGING RESOURCE #1 |

**Comment:** PACKAGING RESOURCE #1
Identify and Stock
Location: LJL M 9-2-9 (2)

| | | |
|---|---|---|
| 13.0 | QC21 | FINAL INSPECTION/W/O RELEASE |

09/02/10 MH

**Comment:** FINAL INSPECTION/W/O RELEASE

Job Completion

MF
09-02-09



Form: rprocess

| DART AEROSPACE LTD | Work Order: | 45304 |
|---|---|---|
| | | |
| Description: Float Web | Part Number: | D3282-041 |
| | | |
| Inspection Dwg: D3282 Rev: C | | Page 1 of 1 |

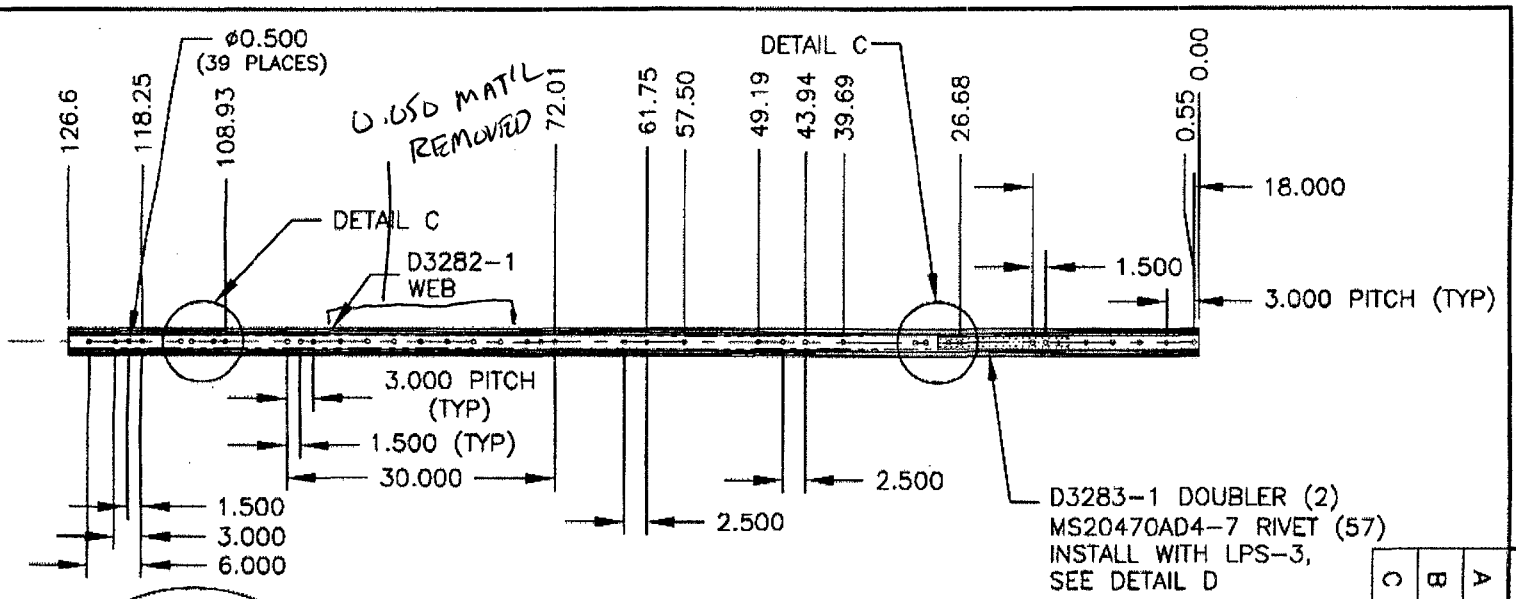
## FIRST ARTICLE INSPECTION CHECKLIST

[X] First Article [ ] Prototype

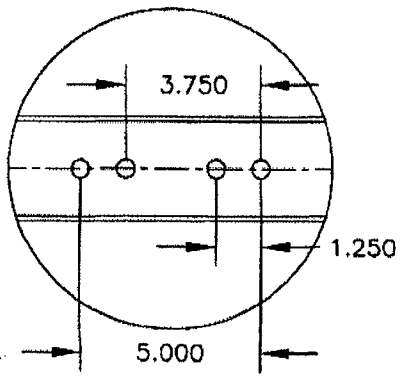
| Drawing Dimension | Tolerance | Actual Dimension | Accept | Reject | Method of Inspection | Comments |
|---|---|---|---|---|---|---|
| 126.6 | +/-0.100 | 126.6 | ✓ | | | |
| 1.500 | +/-0.010 | 1.498 | ✓ | | | |
| 3.000 | +/-0.010 | 2.999 | ✓ | | | |
| 6.000 | +/-0.010 | 5.999 | ✓ | | | |
| 1.250 | +/-0.010 | 1.250 | ✓ | | | |
| 30.000 | +/-0.010 | 30.000 | ✓ | | | |
| 1.500 | +/-0.010 | 1.499 | ✓ | | | |
| 72.01 | +/-0.030 | 72.01 | ✓ | | | |
| 61.75 | +/-0.030 | 61.75 | ✓ | | | |
| 57.50 | +/-0.030 | 57.50 | ✓ | | | |
| 49.19 | +/-0.030 | 49.19 | ✓ | | | |
| 43.94 | +/-0.030 | 43.94 | ✓ | | | |
| 39.69 | +/-0.030 | 39.69 | ✓ | | | |
| 26.68 | +/-0.030 | 26.68 | ✓ | | | |
| 0.55 | +/-0.030 | .550 | ✓ | | | |
| 1.970 | +/-0.010 | 1.973 | ✓ | | | |
| 2.38 | +/-0.030 | 2.379 | ✓ | | | |
| 0.05 | +/-0.030 | .053 | ✓ | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Measured by: | [illegible] | Audited by: | [signature] | Prototype Approval: | N/A |
|---|---|---|---|---|---|
| Date: | [illegible] | Date: | 09/02/03 | Date: | N/A |

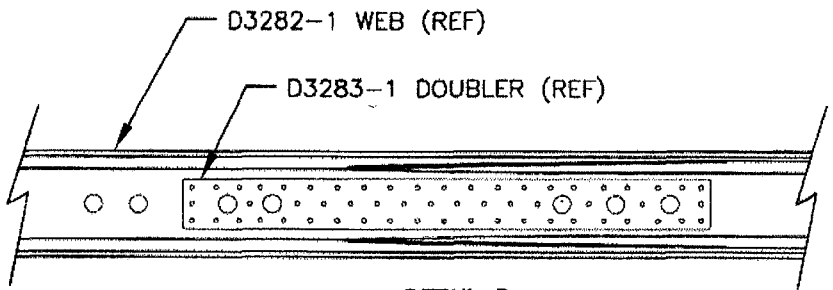
| Rev | Date | Change | Revised by | Approved |
|---|---|---|---|---|
| A | 07.04.02 | New Issue | KJ/JLM | [signature] |




C. USD MAIL REMOVED




**DETAIL C**
SCALE 1:5
RIVET HOLES NOT SHOWN
FOR CLARITY




**DETAIL D**
SCALE 1:5

w/o 45304

RELEASED
05.09.12

**D3282-041 FLOAT WEB**

1) MAKE FROM D2792-130 EXTRUSION
2) FINISH: CHEMICAL CONVERSION COAT PER DART QSI 005 4.1
3) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED
4) BREAK ALL SHARP EDGES 0.010 TO 0.020
5) APPLY A LAYER OF LPS LABORATORIES' LPS-3 BETWEEN D3283-1 DOUBLERS AND D3282-1 WEB. INSTALL RIVETS COATED WITH LPS-3
6) SEE PAGE 2 FOR MACHINING DETAILS

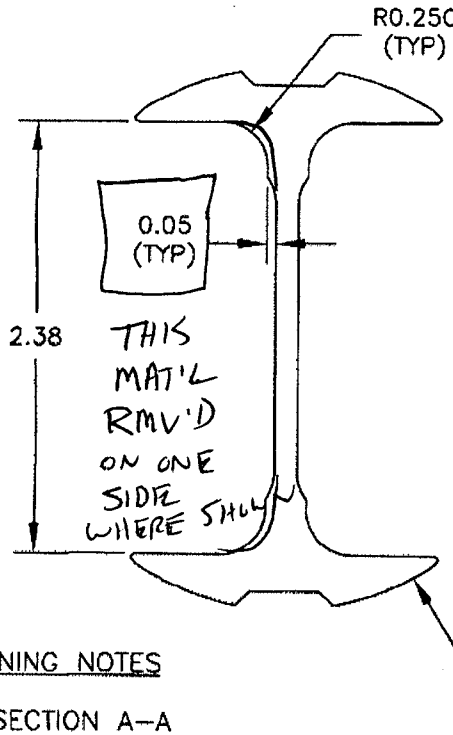
| | | |
|---|---|---|
| C | 05.08.09 | REMOVE D3390-1, NOW MACHINED |
| B | 05.03.16 | MOVE HOLES, ADD D3390-1 DOUBLERS |
| A | 04.05.05 | NEW ISSUE |

DART

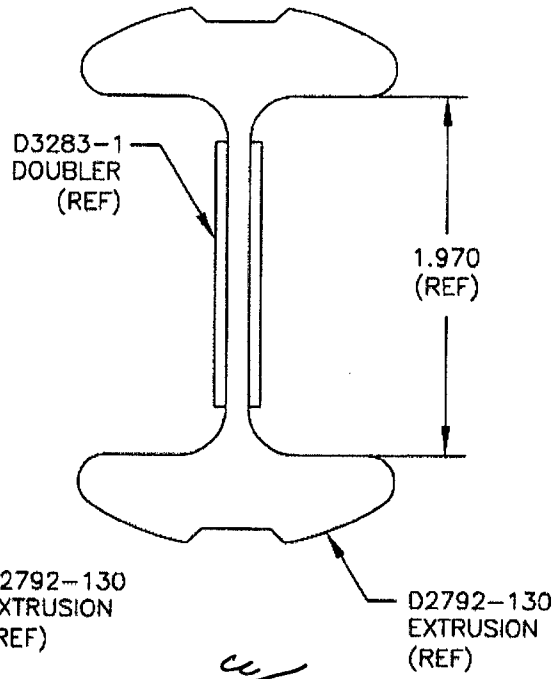
DART AEROSPACE USA, INC.
PORT HADLOCK, WA

| | |
|---|---|
| DESIGN | CP |
| DRAWN BY | CP |
| CHECKED | |
| APPROVED | |
| DATE | 05.08.09 |
| DRAWING NO. | D3282 |
| REV. | C |
| TITLE | FLOAT WEB, 206L/407 |
| SCALE | 1:20 |
| SHEET | 1 OF 2 |

SECTION A–A



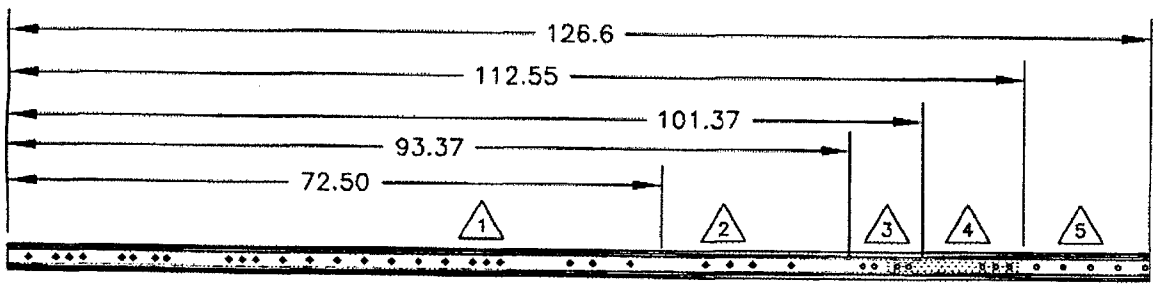

SECTION B–B




w/o 45304

D3282–1 MACHINING NOTES

1. UNIFORM SECTION A–A
2. UNIFORM TAPER FROM SECTION A–A TO SECTION B–B
3. UNIFORM SECTION B–B
4. UNIFORM TAPER FROM SECTION B–B TO SECTION A–A
   DRILL #30 (ø0.128 REF) HOLES (57 PLACES) TO LINE UP WITH D3283–1, SEE DETAIL D FOR REFERENCE
5. UNIFORM SECTION A–A
6. R1.00 BETWEEN SECTIONS




RELEASED
05.04.12

DART

| DESIGN | DRAWN BY | DART AEROSPACE USA, INC. PORT HADLOCK, WA | |
|---|---|---|---|
| CP | CP | | |
| CHECKED | APPROVED | DRAWING NO. | REV. C |
| | | D3282 | SHEET 2 OF 2 |
| DATE | | TITLE | SCALE |
| 05.08.09 | | FLOAT WEB, 206L/407 | 1:20 |

Except from



## 1.0 Introduction

The purpose of this analysis is to substantiate the design of the Dart D206-642-511/-512/-513/-514 Float Skidtubes for the Bell 206L/407 aircraft. The Dart D206-642-511/-512 Float Skidtube installations will be compatible with Apical 614.5501/2 (fwd), 614.5701/2 (mid), and 614.5607/8 (aft) Tri-Bag Emergency Floats that are FAA STC'd per SR01535LA. The Dart D206-642-513/-514 Float Skidtube installations will be compatible with Apical Tri-Bag Emergency floats and Bell OEM float systems.

The D206-642-511/-512 Skidtubes will replace the 206-053-184-113/-114/-117/-118/-121/-122 float skidtubes but will not be compatible with OEM floats. The D206-642-513/ -514 Skidtubes will replace the 206-053-184-113/-114/-117/-118/-121/-122 float skidtubes and will be compatible with OEM and Apical floats.

## 2.0 Material Properties

2.1 Material Properties Dart Skidtubes (6061-T6 QQ-A-200/8)

(Refer to drawing D2600 & D2792. Material properties are listed in Reference 1 Page 7A)

| | | | |
|---|---|---|---|
| $E := 10000000 \cdot lb \cdot in^{-2}$ | Young's Modulus for Aluminum | | |
| $Ftu1 := 40000 \cdot lb \cdot in^{-2}$ | Tension (ultimate) | $Fsu1 := 26000 \cdot lb \cdot in^{-2}$ | Shear (ultimate) |
| $Fcy1 := 34000 \cdot lb \cdot in^{-2}$ | Compression (yield) | $Fbru1 := 82000 \cdot lb \cdot in^{-2}$ | Bearing (ultimate) |
| $Fty1 := 35000 \cdot lb \cdot in^{-2}$ | Tension (yield) | $Fbry1 := 60000 \cdot lb \cdot in^{-2}$ | Bearing (yield) |
| $\mu := 0.33$ | Poisson's ratio | | |

## 3.0 Skidtube Geometry

Figure 2 in Reference 1 illustrates the geometry involved in the Dart skidtube design. These dimensions have been extracted from dwgs D2600 and D2792. The D2792 web extrusion is machined in sections to reduce weight. The D206-642-511/-512/-513/-514 skidtubes have the same geometry, however the -513/-514 has additional holes needed for the OEM floats.

| | | |
|---|---|---|
| $c := 1.575 \cdot in$ | | Skidtube outer radius |
| $tf := 0.095 \cdot in$ | | Flange thickness on skidtube |
| $df := 0.188 \cdot in$ | | Diameter of float bag attachment holes |
| $Dsad := 76.28 \cdot in$ | | Distance between saddles |
| $Itube := 0.986 \cdot in^4$ | | Inertia of D2600-1 tube extrusion |
| $Iweb1 := 1.30 \cdot in^4$ | was 1.333 | Inertia of D2792 web extrusion (max machining) |
| $Iweb2 := 2.067 \cdot in^4$ | | Inertia of D2792 web extrusion (unmachined) |
| $Idblr1 := 0.016 \cdot in^4$ | | Inertia of D3283-1 doubler (on aft bend of web) |
| $Id1 := Itube + Iweb1$ | $Id1 = 2.286 \cdot in^4$ | Dart 206L/407 skidtube inertia (fwd of aft saddle, between saddles, the web is machined web) |
| $Id2 := Itube + Iweb2 + 2 \cdot Idblr1$ | $Id2 = 3.085 \cdot in^4$ | Dart 206L/407 skidtube inertia at aft saddle (web is unmachined) |

## 6.0 Skidtube Substantiation

### 6.1 General

From tests conducted by Dart on similar skidtubes (Reference 1, Page 4A, 4B, 4C), the round I-beam section has a shape factor of 1.22. Calculation shows that the Dart skidtube without the I-beam (Reference 1, Page 4D) has a shape factor of 1.27 and that the skidtube with the D2792 web has a shape factor of 1.32 (Reference 1, Pages 4E & 4F). For simplicity a shape factor of 1.22 will be conservatively used for all sections. The data presented in TR-P305-1 has been accepted by the FAA during the OH-58 skidtube approval (SR00912SE). Therefore the modulus of rupture can be extended according to C3.14 of Bruhn. The table C3.2 of Bruhn gives values for the Plastic Bending Factor, "fo", for varying "Fty" and "Ftu". The value of "fo" is adjusted here for "Fty" and "Ftu" for extruded 6061-T6 (QQ-A-200/8).

$K := 1.22$ Shape factor

A safety factor of 1.5 per FAR 27.303 will be applied for design to ultimate loads.

$sf := 1.5$ Safety factor

A fitting factor of 1.15 per FAR 27.625 will be applied where fasteners are used to transfer loads.

$ff := 1.15$ Fitting factor

### 6.2 Bending at Forward Saddle (section A-A)

As shown in section 3.4 of this document, the FAR 27.501f1 loading causes a larger bending moment at the forward saddle than the forward float load. If the skidtube can withstand the loading of FAR 27.501f1 then it will also withstand forward float bag loading.

$Mf1 = 42238 \cdot lb \cdot in$ Bending moment at fwd saddle from FAR 27.501f1

Yield Bending (compression)

$Sbc1 := \frac{Mf1 \cdot c}{Id1}$ $Sbc1 = 29101 \cdot lb \cdot in^{-2}$ Yield tensile stress at forward saddle from bending

$Fcy1 = 34000 \cdot lb \cdot in^{-2}$ 6061-T6 Yield compressive strength

$MSt1 := \frac{Fcy1}{Sbc1} - 1$ $MSt1 = 0.17$ Margin of Safety

WAS 0.19

Ultimate Bending

$Sbu1 := \frac{Mf1 \cdot sf \cdot c}{Id1}$ $Sbu1 = 43651 \cdot lb \cdot in^{-2}$ Ultimate tensile stress at forward saddle from bending

$Ftu1 = 40000 \cdot lb \cdot in^{-2}$ 6061-T6 Ultimate tensile strength

$fo := Ftu1 \cdot \frac{40500}{42000}$ $fo = 38571 \cdot lb \cdot in^{-2}$ Adjusted plastic bending factor (Bruhn section C3.14)

$Fb := Ftu1 + fo \cdot (K - 1)$ $Fb = 48486 \cdot lb \cdot in^{-2}$ Stress to rupture skidtube (Bruhn section C3.14)

$MSu1 := \frac{Fb}{Sbu1} - 1$ $MSu1 = 0.11$ Margin of Safety

WAS 0.13

**6.3 Bending at Forward End of the Web (section G-G)**

The section of skidtube forward of the forward saddle changes at the end of the web (I-beam). This section is analysed for the FAR 27.501f1 loading. If this section can withstand the loading of FAR 27.501f1 then it will also withstand forward float bag loading. This section is 8.7in aft of the fwd tangent point.

$Dvfwd2 := 8.7 \cdot in$ Distance to web from skidtube's fwd tangent point

$Mf1b := W \cdot Dvfwd2 - W \cdot c$ $Mf1b = 16160 \cdot lb \cdot in$ Bending moment at fwd end of web from FAR 27.501f1

Yield Bending (compression)

$Sbc1b := \frac{Mf1b \cdot c}{Itube}$ $Sbc1b = 25813 \cdot lb \cdot in^{-2}$ Yield tensile stress at forward saddle from bending

$Fcy1 = 34000 \cdot lb \cdot in^{-2}$ 6061-T6 Yield compressive strength

$MSt1b := \frac{Fcy1}{Sbc1b} - 1$ $MSt1b = 0.32$ Margin of Safety

Ultimate Bending

$Sbu1b := \frac{Mf1b \cdot sf \cdot c}{Itube}$ $Sbu1b = 38720 \cdot lb \cdot in^{-2}$ Ultimate tensile stress at forward saddle from bending

$Ftu1 = 40000 \cdot lb \cdot in^{-2}$ 6061-T6 Ultimate tensile strength

$fo := Ftu1 \cdot \frac{40500}{42000}$ $fo = 38571 \cdot lb \cdot in^{-2}$ Adjusted plastic bending factor (Bruhn section C3.14)

$Fb := Ftu1 + fo \cdot (K - 1)$ $Fb = 48486 \cdot lb \cdot in^{-2}$ Stress to rupture skidtube (Bruhn section C3.14)

$MSu1b := \frac{Fb}{Sbu1b} - 1$ $MSu1b = 0.25$ Margin of Safety

**6.4 Bending in Mid Section Between Crosstubes (section B-B)**

The load from the mid float will be modelled as a point load at the center of volume with the saddles acting as simple supports. This is conservative because a distributed load (ie. at the 3 bolt locations) or rigid supports would distribute the load and result in a smaller maximum stress value.

$Mm1 = 31253 \cdot lb \cdot in$ Max bending moment in mid section of skidtube for simply supported beam with point load.

Yield Bending (compression)

$Sbc2 := \frac{Mm1 \cdot c}{Id1}$ $Sbc2 = 21533 \cdot lb \cdot in^{-2}$ Max yield bending stress

$MSt2 := \frac{Fcy1}{Sbc2} - 1$ $MSt2 = 0.58$ Margin of Safety

WAS 0.6

Ultimate Bending

$Sbu2 := \frac{Mm1 \cdot sf \cdot c}{Id1}$ $Sbu2 = 32299 \cdot lb \cdot in^{-2}$ Max ultimate bending stress

$fo := Ftu1 \cdot \frac{40500}{42000}$ $fo = 38571 \cdot lb \cdot in^{-2}$ Adjusted plastic bending factor (Bruhn section C3.14)

$Fb := Ftu1 + fo \cdot (K - 1)$ $Fb = 48486 \cdot lb \cdot in^{-2}$ Stress to rupture skidtube (Bruhn section C3.14)

$MSu2 := \frac{Fb}{Sbu2} - 1$ $MSu2 = 0.50$ Margin of Safety

WAS 0.52

MARGINS STILL POSITIVE

GP 09.02.03